WHAT IS CLAIMED IS:

1. A method for single molecule identification of a target DNA molecule in a random coil state comprising the following steps:

a) attaching an optically distinguishable material to a DNA sequence recognition unit;

b) hybridizing said DNA sequence recognition unit to said target DNA molecule in a random coil state to form a hybridized DNA complex in a random coil state;

c) passing said hybridized DNA complex in a random coil state from a reservoir in a microfluidic device through a narrow channel to cause an acceleration of flow through said channel, thereby causing said hybridized DNA complex to extend into a substantially linear configuration; and

d) detecting said optically distinguishable material in a sequential manner along said substantially linear hybridized DNA complex, thereby identifying said target DNA molecule.

2. The method of claim 1 wherein said optically distinguishable material comprises colored microparticles.

3. The method of claim 1 wherein said optically distinguishable material comprises microparticles having different shapes.

4. The method of claim 2 wherein said colored microparticles comprise dyes, dye aggregates, pigments or nanocrystals.

5. The method of claim 1 wherein said DNA sequence recognition unit comprises DNA, DNA fragments, synthetic oligonucleotides or peptide nucleic acids.

6. The method of claim 1 wherein said DNA sequence recognition units comprise any protein scaffold or synthetic molecular moiety capable of recognizing a specific DNA sequence.

7. The method of claim 1 wherein said narrow channel of said microfluidic device has a width or depth of from about 0.1 μm to about 500 μm.

8. The method of claim 1 wherein said narrow channel of said microfluidic device has a width or depth of about 1 μm to about 300 μm.

9. The method of Claim 1 wherein said microfluidic device is fabricated by photolithography, dry plasma etching, wet chemical etching, laser ablation, air abrasion, injection molding or embossing.